

The Effect of Post-Curing Sulphuric Acid Water Bath on Strong Concrete Press Comes from Three Different Sand Quarry

Agyanatha Tua Munthe, Yudhistira Saptapringga Riesky Sundani
Faculty Of Engineering ,Mercuri Buana University, Jakarta, Indonesia
agyanata.umb@gmail.com, yudhis797@gmail.com

Abstract

Concrete is one of the construction materials that has been commonly used for building buildings, bridges, roads, and others. Concrete as well as other building structures, not separated from damage - damage that can reduce its durability, one of the reasons is because of external influences or the environment in which the concrete structure is located, such as in certain locations, for example in environments related to chemicals, sulfate, chloride, salt or those in marine areas. The purpose of the study was the effect of sulphuric acid water baths on confensional concrete and knowing the concrete with a mixture of sand from which areas were strong press higher after being soaked with sulphuric acid soaking. The research method used is to use the experimental method by mixing sulphuric acid compounds in water as a medium of concrete curing derived from three different sand quarrys with variations in the composition of sulfuric acid compounds that are berberda umtuk get strong press results data from this study. From the results of this study, the conclusion that normal concrete derived from mountain sand namely Cimangkok sand (CMK), and Cigombong (BHM) is more resistant to sulphuric acid concentrations of 2% and 5%. Normal concrete derived from river sand i.e. Citarik sand (CTK) is not resistant to sulphuric acid concentrations of 2% and 5% which results in a lower press strength than mountain sand. Normal concrete derived from a mixture of river sand (Citarik) and mountain sand (Cimangkok and Cigombong) called Sand Mix (MX) is more resistant to sulphuric acid concentrations of 5% than other sand

Keywords

Marinade, Quarry Sand, Strong Press, Water Sulfuric Acid

1. Introduction

Concrete is one of the construction materials that has been commonly used for building buildings, bridges, roads, and others. Concrete is homogeneous, this concrete can be obtained by mixing fine aggregate (sand), coarse aggregate (gravel), or other types of aggregate and water with porland cement or other hydraulic cement, sometimes with additives that are chemical or physical.

Concrete as well as other building structures, not separated from damage - damage that can reduce its durability, one of the reasons is because of external influences or the environment in which the concrete structure is located, such as in certain locations, for example in environments related to chemicals, sulfate, chloride, salt or those in marine areas. Sulfate content in soil and groundwater, decay of organic materials, and industrial waste surrounding a concrete structure can pose a threat to the long-term durability of the concrete (Fanisya and Gunawan, 2013).

Sand is one of the most important types of building materials that must exist in the construction process, matrial of this building in the form of granules with the size that has been determined. Although the magnitude of the grain of sand is determined, there are several different types of sand that are accounted for for matrial building, this different type that makes granules to the function of sand different.

Characteristic of sand, sand aggression is formed from erosion or weathering of rocks until it becomes small grains smaller than 4.75 mm in diameter. Most of these natural sand aggregates have a type weight between 1500-1700 kg/m³ and the type weight can reach 2000 kg/m³. (Sulaiman and Nurhidayah, 2018)

Sulfuric acid is a very strong mineral acid (inorganic substance). This substance is soluble in water, sulfuric acid has the chemical formulation H₂SO₄, and has a molar mass of 98.08 g / mol. Sulfuric acid looks like Hygroscopic, oily, colorless, and odorless liquid.

The use of concrete structures that are in direct contact with sulphuric acid compounds will affect the strong quality of concrete press because sulfuric acid can make concrete corrosion (Suhana and Mualifah, 2017). Corrosion has been known for a long time and is very detrimental. The word corrosion is derived from latin corrodere which means metal destroyer or rusty (Supardi, 1997)

Based on the background description above, a search was conducted with the title "Effect of Post Curing Sulfuric Acid Water Bath on Strong Press Concrete Coming From Three Different Sand Quarry".

2. Methodology

The research method used is to use the experimental method by mixing sulphuric acid compounds in water as a medium of concrete curing derived from three different sand quarries with variations in the composition of sulfuric acid compounds that are berberda untuk get strong press results data from this study.

This research was conducted using Mix Design which refers to the national standard sni 03-2834-2000

. In this study the sand used for concrete making mixture comes from three different sand quarry, namely cigombong quarry, cimangkok quarry, sukabumi quarry. As for curing on concrete will be done substitution against water i.e. by using sulphuric acid compounds with the following presentase variations namely 0%, 2%, and 5% of the volume of the tub that will be used as a place to soak concrete for 7, 21, 28 days.

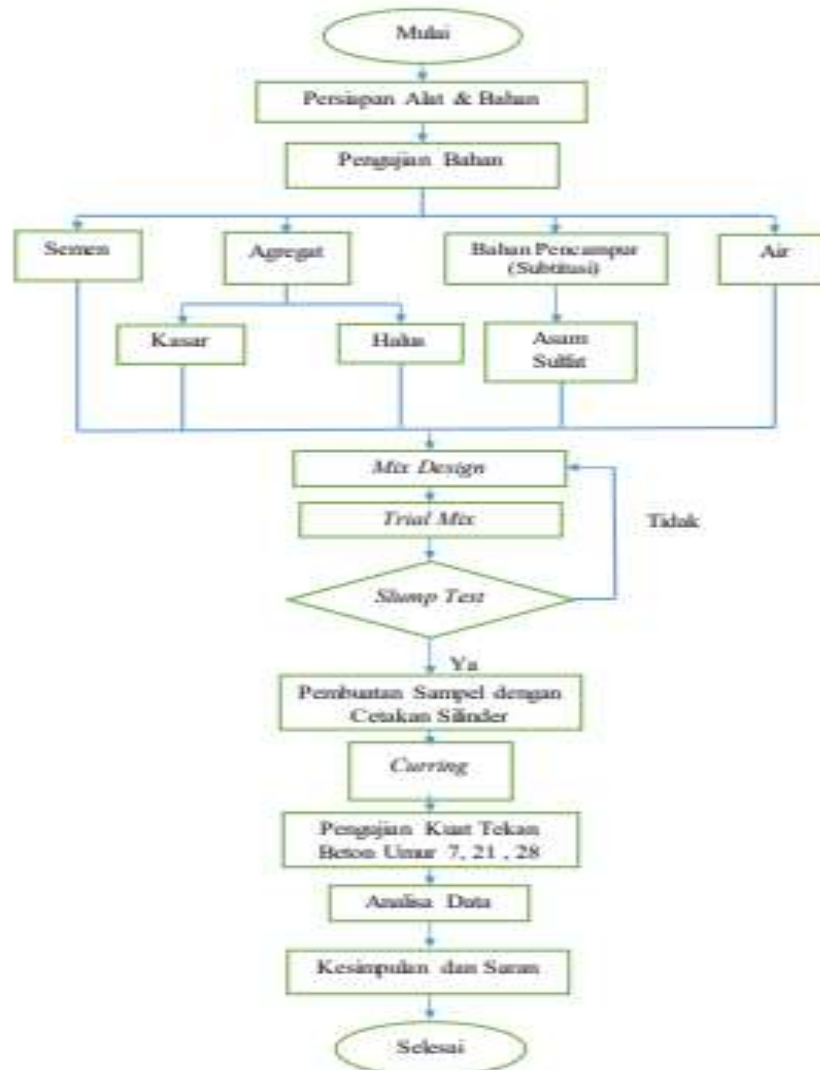


Figure 1. Metode
 Source : Olahan Peneliti

This research begins by preparing the tools and materials to be used. The tool that will be used in the laboratory is ensured to be in good condition and has been calibrated before, then conducts testing on the material to be used and continued with the planning of the calculation of the design mix using Microsoft Excel software with calculations referring to SNI 03-2834-2000. Then do a trial mix and slump test. After 24 hours the concrete will be opened from the mold and continued by curing by soaking the sample into a tub filled with water mixed with sulphuric acid compounds. In this process the concrete sample will be soaked for 7, 21, 28 days before the strong testing of the concrete press, after the life of the concrete is reached then the concrete will be removed

from the tub and then will begin the testing of strong press concrete and will be obtained the results of strong data press.

- Cement cement that will be used in this study is three-wheeled cement weighing 40 kg / zak which is portland cement type I.
- The sand used in this study comes from three different sand quarys. The three sand quarys are quarry Cigombong, quarry cimangkok, quarry Sukabumi.
- Gravel gravel to be used in this research obtained from Rumpin.
- Sulfuric acid sulfuric acid used in this study is sulfuric acid found in the Laboratory.
- Water used in this study in the laboratory.

Table 1. Material Needs To Make 1 M3 Concrete

Materials	Kg/m ³
Semen	325
Air	185
Agregat Halus	823
Agregat Kasar	1006

Place and Time

Place : This research will be conducted in the jakarta-Bandung plan halim high-speed train laboratory.

Time : This research will start from June to July 2020.

3. Result and Discussion

3.1. Analysis of cimangkok sand filter

This stage aims to know the size of the grain and the arrangement of grains (gradations) of fine aggregates (sand) based on the filter number. So that it can determine the modulus smoothness of the sand.

Table 2. Results of Analysis of Fine Aggregate Gradation of Cimangkok Sand

Saringan	Berat Bahan Kering Cimangkok : 2000,0 gr		Jumlah Persen	
	Berat Tertahan (gram)	Jumlah Berat Tertahan	Tertahan	Lewat
50.80 (2")				
25.40 (1")				
19.10 (3/4")				
6.3 (1/4")	-	-	0,00	100,00
No. 4	360	360,00	18,00	82,00
No. 8	320,00	680,00	34,00	66,00
No. 12	100,00	780,00	39,00	61,00
No. 16	80,00	860,00	43,00	57,00
No. 30	270,00	1130,00	56,50	43,50
No. 50	260,00	1390,00	69,50	30,50
No. 80	310,00	1700,00	85,00	15,00
No. 100	120,00	1820,00	91,00	9,00
No. 200	110,0	1930,00	96,50	3,50
PAN	70,0	2000,0	100,00	0,00
Fineness Modulus	4,36			

3.2. Results of analysis of fine aggregate filter of Sukabumi sand (Citarik)

This stage aims to know the size of the grain and the arrangement of grains (gradations) of fine aggregates (sand) based on the filter number. So that it can determine the modulus smoothness of the sand.

Table 3. Citarik Sand Fine Aggregate Gradation Analysis Results

Saringan	Berat Bahan Kering Sukabumi : 2000,0 gr		Jumlah Persen	
	Berat Tertahan (gram)	Jumlah Berat Tertahan (gram)	Tertahan	Lewat
50.80 (2")				
25.40 (1")				
19.10 (3/4")				
6.3 (1/4")	-	-	0,00	100,00
No. 4	450	450,00	22,50	77,50
No. 8	790,00	1240,00	62,00	38,00
No. 12	140,00	1380,00	69,00	31,00
No. 16	70,00	1450,00	72,50	27,50
No. 30	180,00	1630,00	81,50	18,50
No. 50	160,00	1790,00	89,50	10,50
No. 80	140,00	1930,00	96,50	3,50
No. 100	20,00	1950,00	97,50	2,50
No. 200	40,0	1990,00	99,50	0,50
PAN	10,0	2000,0	100,00	0,00
Fineness Modulus	5,91			

3.3. Analysis of cigombong sand fine aggregate sieve (Bulb)

This stage aims to know the size of the grain and the arrangement of grains (gradations) of fine aggregates (sand) based on the filter number. So that it can determine the modulus smoothness of the sand.

Table 4. Cigombong Sand Fine Aggregate Gradation Analysis Results

Saringan	Berat Bahan Kering Cigombong : 2000,0 gr		Jumlah Persen	
	Berat Tertahan (gram)	Jumlah Berat Tertahan	Tertahan	Lewat
50.80 (2")				
25.40 (1")				
19.10 (3/4")				
6.3 (1/4")	-	-	0,00	100,00
No. 4	320	320,00	16,00	84,00
No. 8	540,00	860,00	43,00	57,00
No. 12	145,00	1005,00	50,25	49,75
No. 16	120,00	1125,00	56,25	43,75
No. 30	350,00	1475,00	73,75	26,25
No. 50	170,00	1645,00	82,25	17,75
No. 80	110,00	1755,00	87,75	12,25
No. 100	83,00	1838,00	91,90	8,10
No. 200	90,0	1928,00	96,40	3,60
PAN	72,0	2000,0	100,00	0,00
Fineness Modulus	5,01			

3.4. Sand Mix fine aggregate sieve analysis results

This stage aims to know the size of the grain and the arrangement of grains (gradations) of fine aggregates (sand) based on the filter number. So that it can determine the modulus smoothness of the sand.

Table 5. Results of Fine Aggregate Gradation Analysis of Sand mix

Saringan	Berat Bahan Kering Mix : 2000,0 gr		Jumlah Persen	
	Berat Tertahan (gram)	Jumlah Berat Tertahan (gram)	Tertahan	Lewat
50.80 (2")				
25.40 (1")				
19.10 (3/4")				
6.3 (1/4")	-	-	0,00	100,00
No. 4	470	470,00	23,50	76,50
No. 8	580,00	1050,00	52,50	47,50
No. 12	100,00	1150,00	57,50	42,50
No. 16	90,00	1240,00	62,00	38,00
No. 30	200,00	1440,00	72,00	28,00
No. 50	160,00	1600,00	80,00	20,00
No. 80	180,00	1780,00	89,00	11,00
No. 100	50,00	1830,00	91,50	8,50
No. 200	100,0	1930,00	96,50	3,50
PAN	70,0	2000,0	100,00	0,00
Fineness Modulus	5,28			

Here are the strong press results from the slump testing on the search this time: Hasil test slump

Table 6. Slump Test

Pasir	Nilai Slump (cm)
Cimangkok	9
Sukabumi (Citarik)	10
Cigombong (Bohlam)	8
Mix (Cimangkok,Cigombong,Sukabumi)	8,5

Table 7. Strong results press sukabumi sand (citarik)

JMF CTK 0%	Asam sulfat 0%
7	12,18
21	4,36
28	15,79
JMF CTK 2%	Asam sulfat 2%
7	12,06
21	4,05
28	14,7
JMF CTK 5%	Asam sulfat 5%
7	11,94
21	4,77
28	15,48

Table 8. Strong results of Cimangkok sand press

JMF CMK 0%	Asam sulfat 0%
7	11,58
21	8,42
28	19,36
JMF CMK 2%	Asam sulfat 2%
7	11,72
21	9,38
28	14,54
JMF CMK 5%	Asam sulfat 5%
7	11,35
21	8,5
28	16,8

Table 9. Strong result of Cigombong sand press (Bulb)

JMF BHM 0%	Asam sulfat 0%
7	13,73
21	6,5
28	18,34
JMF BHM 2%	Asam sulfat 2%
7	14,45
21	7,58
28	16,56
JMF BHM 5%	Asam sulfat 5%
7	14,36
21	7,14
28	18,83

Table 10. Strong result press sand Mix

JMF MX 0%	Asam sulfat 0%
7	13,02
21	5,71
28	15,87
JMF MX 2%	Asam sulfat 2%
7	13,61
21	5,88
28	16,11
JMF MX 5%	Asam sulfat 5%
7	13,29
21	5,91
28	20,15

4. Conclusion

1. Normal concrete derived from mountain sand namely Cimangkok sand (CMK), and Cigombong (BHM) is more resistant to sulphuric acid concentrations of 2% and 5%.
2. Normal concrete derived from river sand i.e. Citarik sand (CTK) is not resistant to sulphuric acid concentrations of 2% and 5% resulting in stronger press lower than mountain sand.
3. Normal concrete derived from a mixture of river sand (Citarik) and mountain sand (Cimangkok and Cigombong) called sand Mix (MX) is more resistant to sulphuric acid concentration 5% than other sand.
4. Normal concrete on the 7th day that is resistant with sulphuric acid concentration 0% with strong highest press is Cigombong sand with a strong press number 13.73 Mpa, then sand Mix with strong number press 12.18 Mpa, Citarik sand with strong press 12.18 Mpa, and last sand Cimangkok 11.58 Mpa.
5. Normal concrete on the 7th day that is resistant with sulphuric acid concentration 2% with strong highest press is Cigombong sand with a strong press number of 14.45 Mpa, then sand Mix with a strong number press 12.06 Mpa, citarik sand with strong press 12.06 Mpa, and last sand Cimangkok 11.72 Mpa.
6. Normal concrete on the 7th day that is resistant with sulphuric acid concentration 5% with strong highest press is cigombong sand with a strong press number 14.36 Mpa, then Chapter V Cover V-2 sand Mix with a strong press number 13.29 Mpa, citarik sand with strong press 11,94 Mpa, and finally cimangkok sand 11.35 Mpa.
7. Normal concrete on the 21st day that is resistant with sulphuric acid concentration 0% with strong highest press is Cimangkok sand with a strong number press concrete 8.42 Mpa, then cigombong sand with a strong press number 6.5 Mpa, Pasir Mix with strong press 4.36 Mpa, and finally citarik sand with strong press 4.36 Mpa.
8. Normal concrete on the 21st day that is resistant with sulphuric acid concentration 2% with strong highest press is Cimangkok sand with a strong number press concrete 9.38 Mpa, then cigombong sand with a strong press number 7.58 Mpa, Pasir Mix with strong press 4.05 Mpa, and finally citarik sand with strong press 4.05 Mpa.
9. Normal concrete on the 21st day that is resistant with sulphuric acid concentration 5% with strong highest press is Cimangkok sand with a strong number press concrete 8.50 Mpa, then cigombong sand with a strong press number 7.14 Mpa, Pasir Mix with strong press 5.91 Mpa, and finally citarik sand with strong press 4.77 Mpa.
10. Normal concrete on the 28th day that is resistant with sulphuric acid concentration 0% with strong highest press is Cimangkok sand with a strong number press concrete 19.36 Mpa, then cigombong sand with a strong press number 18.34 Mpa, Citarik Sand with strong press 15.79 Mpa, and finally sand Mix with strong press 15.79 Mpa.
11. Normal concrete on the 28th day that is resistant with sulphuric acid concentration 2% with strong highest press is Cigombong sand with a strong number press concrete 16.56 Mpa, then sand Mix with strong press number 14.70 Mpa, Citarik Sand with strong press 14.70 Mpa, and last cimangkok sand with strong press 14.54 Mpa.
12. Normal concrete on the 28th day that is resistant with sulphuric acid concentration 5% with strong highest press is sand Mix with strong number press concrete 20.15 Mpa, then Chapter V Cover V-3 cigombong sand with strong number press 18.83 Mpa, Cimangkok Sand with strong press 16.80 Mpa, and lastly citarik sand with strong press 15.48 Mpa.

13. From this research it can be concluded that the concrete includes the natural group of grade I concrete that is non-structural concrete.

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Biography / Biographies (Optional)

Yudhistira Saptapringga Riezky Sundani is a student from Mercu Buana University Bekasi with civil engineering study program. Prior to majoring in civil engineering, at the previous level of high school, he majored in Natural Sciences at a private school in Jakarta, namely PGRI 4 Cipayung East Jakarta. The writer graduated from high school in 2016 and then went on to study at Mercu Buana University in 2016. During the lecture the author was active in various campus events such as the asco pensi committee, vice chairman of cultural seminars. For activeness in the department, namely as Chief Executive of Civil Expo 2019, as the committee of the night of familiarity 2017. In the course of lectures the author does work as a Surveyor in a consultant, and as a surveyor in the Central Bureau of Statistics (BPS).

Agyanatha Tua Munthe, a lecturer from Mercubuana University Bekasi, mr. Agyanatha studied at Atmajaya University in Yogyakarta, majoring in civil engineering and graduated in 2004 with a bachelor's degree in engineering. Mr. Agyanatha then went on to study at Gadjah Mada University in Yogyakarta, majoring in civil engineering and graduating in 2006 with a megister engineering degree. In 2007 – 2010 Mr. Agyanatha worked at PT. INDALEX (MASPION GROUP) and served as a site engineer. PT. DUTA SARANA PERKASA (Dusaspun) in 2010 – 2013 served as Technical Sales Engineer M-System, PT CIPTA MORTAR UTAMA (CMU) in 2013 march- 2013 december served as Ass. Manager Technical External Development then in 2014 – 2016 served as Jr. Manager Product Management. PT BOSTIK INDONESIA in 2016 – 2017 served as Senior Technical Consultant and Support Sales. PT. MASJAYA SEJAHTERA in 2017 until now serves as Project Manager.